Informaticians

How They May Benefit Your Healthcare Organization

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The heightened focus on health information technology deployment, specifically the electronic health record, has magnified the need for the knowledge and skills of informaticians. The clinical informatician is frequently confused with system analyst and project management roles. In this article, the authors explore the knowledge and skills of informaticians and how to determine the skill combinations most suited to an organization and compare the roles of informaticians, project managers, and information technology professionals.

The recent focus on national healthcare policy and meaningful use rules has escalated a sense of urgency in the healthcare community to implement an electronic health record (EHR). The compelling need to begin, continue, or complete an EHR implementation will continue to grow in response to the work of state Health Information Exchanges, the Centers for Medicare and Medicaid (CMS) incentive payment schedule for meaningful EHR use, and future CMS payment penalties for failure to meet meaningful EHR use criteria. As information about these programs is clarified and rules are finalized, healthcare leaders and primary care providers will begin to identify individuals and teams to implement the EHR and ensure data retrieval. Central to the goal of successful implementation and effective meaningful use is identification of the knowledge and skill sets necessary to champion and guide health information technology (HIT) projects in a manner that supports clinical practice and, at a minimum, does not increase risks to patient safety.

While seeking vision, expertise, and guidance for the journey to an EHR, many healthcare leaders are uncertain of the requisite knowledge and skills required to complement their existing staff. And while meaningful use will primarily affect physicians, it will clearly affect the RN practice.

Complex decisions, often with hidden interdependencies, are rooted throughout the journey to an EHR. These decisions are diverse and include change management, cultural change issues, interdisciplinary and interdisciplinary workflow change, creating a balance between structured (coded) text and free text documentation, selection and mapping of terminologies, supporting practitioner cognition and critical thinking, ensuring that new processes do not increase risks to patient safety, and practice implications. The complexity and risks of an EHR implementation are illustrated by reports of EHR project failures.

The process of system selection, design, implementation, and ongoing evaluation can be overwhelming. Information management, knowledge management, human-computer interface, cognitive science, computer science, and project management skill sets are integral to a successful outcome. Expert resources are needed, but identifying the best resources is challenging. Several professional disciplines have important and different expertise to contribute, including computer science, information technology (IT), project management, and clinical informatics.

Nurse informaticians integrate informatics knowledge and their knowledge of nursing science, theory, practice, and culture. Clinical informaticians from other disciplines integrate their knowledge and understanding of the science of their clinical domain with their informatics knowledge. This unique combination

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of clinical and informatics knowledge enables informaticians to focus on the best way to support patient care through integrating people, systems, processes, and IT. The cornerstone of informatics practice is the integration of people, systems, and process with the technology. Furthermore, informaticians need to understand the cross-cultural aspects of language, mental models, and clinical practices so that shared data, information, and knowledge are understood by all.

Experience gained from introduction of IT in organizations demonstrates the imperative of understanding the interactions between people and the relationships between people and systems, workflow, processes, and procedures. This knowledge is the foundation for establishing how to redesign systems, processes, and procedures that incorporate IT tools. The focus is the people and their work environment, not the technology. This awareness has kindled the need for new knowledge and skill sets to manage the transition. Although we cannot deny the criticality of guiding and supporting staff to successfully navigate the introduction of IT, we are actually helping people to revisualize and redesign their information management and knowledge management skills and learn new ways of using clinical data to manage clinical practice and patient care. Informaticians are prepared to facilitate the transition process.

The relatively recent entry of informaticians in healthcare contributes to the confusion regarding what to expect from an informatician. A few professional organizations offer draft job descriptions, and these job descriptions are as varied as the needs of the organizations for which they were developed. Lack of experience with the informatics role has led some organizations to develop job descriptions that model IT practitioner or project management positions.

**Definition of Informatics**

Although the terminology used by informatics practitioners is not well understood by people outside the field, the meaning of selected informatics terminology continues to be debated in the field as well. In recent months, several articles explored the meaning of informatics, the roles of informaticians, and the types of specialization in the informatics discipline. The dialogue indicates a general consensus that informatics incorporates (1) data gathering, (2) data representation to support inferential meaning and understanding, and (3) information management to build new knowledge that can be used to identify and solve healthcare problems. Discussion continues, however, around titles and their meaning and the responsibilities associated with informatics subspecialties. Biomedical informatics (BMI) is a term frequently used and encompasses medical informatics, nursing informatics, clinical informatics, imaging informatics, and others. However, some informatics professionals prefer to use biomedical and health informatics instead of BMI. Given the lack of consensus on terminology in the informatics discipline, it comes as no surprise that healthcare leaders are unclear what type of informatician to recruit and what to expect from an informatician.

The American Nurses Association defines nursing informatics as “a specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, knowledge, and wisdom in nursing practice.” This definition is complementary with the definition of clinical informatics, which is the intersection of informatics with the knowledge of a clinical domain.

**Role Dimensions**

Informaticians are prepared to influence, contribute to, and mold the realization of an organization’s vision for knowledge management. The knowledge and skills of informaticians are integral to creating an environment in which IT is effectively implemented and information and knowledge management are core values. Domain knowledge areas of informaticians are depicted in Figure 1, and the implications of each are briefly discussed here.

**Workflow Analysis**

When IT is introduced into a clinical setting, users may focus their attention on the technology itself—it is new and tangible—rather than on how to integrate the technology into their workflow. Technology is, however, simply a tool. Attention needs to be directed to integrating IT tools into the workflow of practitioners. This process begins with study and careful documentation of the current workflows, processes, relationships, and provider roles to design future workflows that embrace the technology. Study of workflow introduces the opportunity to thoughtfully examine practices, and informaticians are skilled in facilitating and guiding healthcare practitioners as they unravel the complex processes embedded in clinical workflow.

The opportunity of workflow analysis is an examination of the core of clinical practice, including processes, procedures, protocols, handoffs, documentation, knowledge access, and other factors that
are embedded in the rhythm of the unit or office. Truly effective workflow analysis demands that practitioners step back, explore the complexity of their work processes, and identify the steps that are value added and the steps that are the result of habit and tradition. The outcome of effective workflow assessment is a leaner and more functional process. The risk of workflow analysis is failure to fully examine the processes developed as work-arounds in response to broken processes in another portion of the system. Once those work-arounds are designed into an IT system, correcting systemic problems will be much more difficult, and the opportunity to improve productivity and reduce waste will be lost. Second, it is important for the informatician to facilitate the process and guide staff in recognizing that they are in control of their practice and that their new insights will guide how the IT will support them. It is important that clinicians understand that they, not the technology, are in control.

Applied Informatics Science
Informaticians work closely with IT practitioners to integrate the new workflow into system design. An iterative process, system design usually includes review of successive prototypes with the clinical practitioners. Design sessions with clinicians call for many decisions. The informatician’s contextual knowledge and understanding of the practice domain, workflow, and environment are called upon in design sessions, exploring the advantages and disadvantages of design options and ensuring that these factors are clear as clinicians make decisions. The informatician can help tease out the implications of potential decisions that developers or system analysts may not recognize as important to the setting.

Healthcare providers are knowledge workers, accessing and assessing complex clinical information throughout the day. Research demonstrates that screen layout, data proximity, and spatial relationships and how data are represented affect performance and critical thinking. The data and information presented by IT are part of the critical thinking “space” and augment the limited capacity of our working memory. The manner in which system design influences cognition is indicative of the importance of consideration of cognitive factors for patient safety—changing a representation changes perception (Turley, in review). A critical role of the informatician is influencing and evaluating system design from the perspective of clinician cognition.

System evaluation measures whether the application is performing as intended and offers users a structured forum to provide feedback. Users are generally not shy about sharing what is working
or not working the way they anticipated. More formal evaluation processes offer users opportunities to provide feedback and offer suggestions while also identifying the factors that are working well. Informaticians can ensure that evaluation is not lost in the frenzy of system implementation and go-live support, influence system evaluation design, and assist in the interpretation of evaluation results.

**Human-Computer Interface**

The experiences that a clinician has while using IT influence their willingness to continue to use the system and to use the system as intended. Creating and designing an environment that supports positive experiences in the use of IT are a shared responsibility of the implementation team. The process begins by ensuring the informatics competency of users. Current and future workflow guides the selection, number, and placement of workstations. Ergonomic factors are an important consideration in the selection and placement of computer workstations. Informaticians often work with IT and biomedical engineering during the system selection and installation process.

Usability, or user friendliness, is a critical part of the system design process. Heuristic evaluation is the most common process for examining the usability of a system, such as minimizing the information that the user must memorize to use the system, providing the user with prompt and informative feedback, using terms that are understandable to the intended audience, and preventing errors while using the system. Usability testing is an iterative process that is conducted during system design. The informatician’s clinical domain knowledge and understanding of heuristic testing are critical adjuncts of usability testing.

**Meaningful Use: Information and Knowledge Management**

Meaningful use, a prominent discussion topic in recent months, is another perspective of information management and knowledge management. Meaningful use is dependent on collecting the appropriate data in a form that readily supports retrieval, which is generally achieved via structured text responses. Meaningful use also embraces clinical decision support, or algorithms established by clinicians to be important in a specific clinical environment. The data collected and the decision support system help to answer the tough questions about patient outcomes, quality and process improvement opportunities, practice patterns, and patient populations. Terminology, structured text, and compliance data about system use support the development of evidence-based practice and contribute to the meaningful use guidelines (in draft form at this writing) issued by the CMS.

**Knowledge Management**

Knowledge management is generally recognized as a process by which organizations leverage the vast array of information and knowledge represented by its information systems, processes, and employees. Effectively collecting, organizing, representing, and analyzing this intellectual capital are critical to organizational learning and evidence-based strategic planning. Planning information system design and use enhances and leverages downstream knowledge management. The organization’s vision for information retrieval from one or more information systems influences decisions about mapping to a terminology system, use of structured text or free text, the data to be collected, and who will record the data.

Data and information are often difficult to interpret without context. For example, the meaning of blood glucose value may change based on when the last meal was eaten, the time and dose of the last insulin injection, and whether the patient recently completed exercising. Informaticians use their clinical knowledge to ensure that context is considered when appropriate.

Perception and critical thinking are influenced in significant ways by how data are represented. Using knowledge of cognition and working memory, informaticians guide and influence screen design and content. Data proximity, spatial relationships, and configuration influence perception and may have different meanings for different clinical disciplines. For example, the nurse may prefer to see the date and value of the most recent potassium level for a patient taking a potassium-depleting diuretic, whereas the physician may prefer to review the potassium level in the context of all electrolyte values. Informaticians seek to ensure that the perceptual lens of the nurse is woven into the workflow of nurses.

**Leadership Support**

Information systems are created to gather and store data for a purpose. Health IT systems sustain multifaceted purposes, such as clinical decision support, support of evidenced-based practice, and organization and display of information for an individual patient. For these purposes to be realized, it is critical to ensure that the data input is compliant with system design and organizational policies and procedures. Early in the implementation process, and throughout the life of the system, it is important to evaluate how the system is being used. Clinical staff need feedback to understand areas of very good
and excellent documentation practices, as well as feedback regarding where they need to modify current practice to support meaningful data collection. Without timely feedback, staff can only conclude that what they are currently doing must be correct or possibly not important.

In addition, HIT systems can serve as significant decision support resources for strategic planning purposes. Informaticians, in collaboration with organizational leaders, can ensure that important data are captured and aggregated in report formats that support the planning process. Furthermore, informaticians make sure that information systems support nursing practice, not detract from it, and that nurses, not database developers, guide nursing practice.

Sociotechnical
Implementation of IT systems is not about the technology but rather the people, relationships, and systems that the technology will impact. And generally, the IT is introduced into a complex system of individuals, conversations in which information and knowledge are exchanged, and the tools such as processes, procedures, equipment, and others. Informaticians focus on developing a robust understanding of the highly complex social system of a healthcare organization, recognizing that an understanding of sociotechnical systems embraces the characteristics of clinicians, the work clinicians do, and how clinicians perform in various situations. One of the goals of understanding the sociotechnical culture is to avoid information system design that negatively supports cognition, increases short-term memory load, and creates barriers to critical thinking. Other examples of the importance of cultural understanding include (1) the nature and frequency of interruptions, such as telephones, pagers, and other practitioners, and (2) cramped workspaces that may contribute to errors and increase risks to patient safety.

Introduction of change to complex systems such as healthcare is frequently accompanied by unintended consequences that may introduce significant risk of harm to patients, or e-iatrogenesis. Informaticians and software designers must share vigilance to factors that could result in e-iatrogenesis. Informaticians also contribute to minimizing e-iatrogenesis through their understanding of the user’s interface with data, information, and knowledge during the delivery of patient care.23

Informatics Research
Properly prepared informaticians can embark on a program of informatics research that may include translational research and replication studies, as well as new informatics research. In addition, informaticians are often members of clinical research teams, contributing to research design, data collection, data analysis, and publications. Partnerships with academic institutions can further enhance a program of informatics research.

Comparison of IT, Project Management, and Informatician Roles
Clinicians, informaticians, IT practitioners, and project managers each contribute important skills and domain knowledge to the healthcare knowledge management team. Figure 2 depicts the roles that might be typically found in many healthcare organizations and actively involved in the selection, design, implementation, and maintenance of clinical information systems. Each discipline contributes critical domain knowledge and expertise, and each discipline needs the other disciplines that comprise the team to create an effective information system that promotes patient safety.

In general, IT practitioner domain knowledge embraces the hardware, software, and complex infrastructure of information systems. There are many ways in which IT practitioners and informaticians collaborate, including defining the information retrieval expectations and needs of clinical and administrative staff, supporting workflow through effective system configuration, guiding hardware selection to support multiple clinical roles, and advocating for applications and software that support clinical practice and patient safety.

Project managers and informaticians interface to ensure that project timelines and budget projections are on target. Informaticians contribute to the development of the project plan and timeline by ensuring that sufficient time and resources are committed to workflow analysis, education plan development, staff training, and project evaluation.

Clinical practitioners, who are the customers of the IT practitioners, project managers, and informaticians, represent the needs of the patient care team. The clinical expertise of clinical practitioners drives the definition of system requirements, system and process redesign, and information retrieval requirements.

Informatician Recruitment
Informatician is not an entry-to-practice role. Clinically experienced nurses can seek informatics specialization through on-the-job training, informatics certification programs, and academic degree-granting programs. A comprehensive list of...
international academic and other training programs is available on the American Medical Informatics Association (AMIA) Web site.\textsuperscript{24}

Nurse/clinical/healthcare informatician recruitment pathways are similar to those of other high-demand healthcare roles. Options include universities with informatics degree-granting programs and professional associations such as AMIA, Health Information Management Systems Society,\textsuperscript{25} and American Nursing Informatics Association-Capital Area Roundtable Nursing Informatics Group (ANIA-CARING)\textsuperscript{26} host sites to connect informaticians seeking employment and employers with open informatician positions. Healthcare recruiters provide another recruitment avenue for healthcare informaticians.

Nurse informaticians may fulfill a leadership role in the design, implementation, and evaluation of clinical information systems. Furthermore, nurse informaticians may serve as role models, coaches, mentors, and preceptors to clinical nurses as they develop informatics competencies. The Technology Informatics Guiding Education Reform (TIGER) is a broad-based coalition of nursing leadership organizations. The criticality of mainstreaming informatics competency in nursing education programs across the globe is promoted and championed by TIGER.\textsuperscript{27}

The chief nurse informatician is generally employed at a manager or director level. Multisite systems often establish a corporate-level chief nursing informatics officer role (CNIO) that provides informatics direction and promotes standards between divisions. Nurse informaticians typically report to the chief nursing officer (CNO), working in partnership with the CNO and directors of nursing in the transformation of nursing practice that can result for an EHR implementation. Other reporting options include the director of quality improvement or the chief information officer (CIO).

The reporting relationship of the chief nurse informatician position may have a subtle influence on the development of nursing staff buy-in and ownership of the EHR. Nurses may identify more closely with a nurse informatician who is recognized as a part of the nursing department. Nurse informaticians who report to the information systems department may find that they need to be more intentional in developing and maintaining a partnership with nursing end-users.

**Conclusion**

Implementation of clinical information systems is complex, requiring the domain knowledge of multiple disciplines, including clinical, project management, IT, and informatics. Informaticians complement
the skills of the other members of the healthcare knowledge management team, bringing unique knowledge and skills to facilitate the work of clinical practitioners. Knowledge management, meaningful use, human-computer interface, applied informatics science, workflow analysis, sociotechnical assessment, leadership support, and informatics research are important dimensions that healthcare organizations need to craft the roadmap and guide the journey of information system implementation. Nursing informaticians are prepared to ensure that nursing practice is the focus of the system, rather than requiring nurses to adapt to the workflow of the system.

References